

### *Best-Practice Benchmarking Abroad*

Best-practice benchmark regulation is not limited to the United States. The European Commission has adopted a type of best-practice benchmark approach to assessing prices for access to public switched telecommunications networks and recommending maximum interconnection charges. The Commission established “best current practice” interconnection charges that are based on the three Member States with the lowest interconnection rates (the UK, France, and Denmark). The Commission’s methodology establishes a benchmark range, with the low rate set somewhat below the lowest access price available. Starting January 1, 1999, the best current practice rate for local interconnection, for example, is the range 0.5 – 1.0 Eurocent (0.6 to 1.2 US cents) per minute (at peak rate). The interconnection benchmark rate will establish an incentive for national regulators in a number of countries to reduce high interconnection rates. As of May 1998, eleven of the fifteen Member States had local interconnection rates that exceeded the upper end of the benchmark range and in five of those states the rates were more than 80% above the upper benchmark value.<sup>37</sup> In the context of antitrust cases brought under the European Union’s competition law, an interconnection price that is more than 100% above a best practice rate will be taken to signal a substantial likelihood of an abuse.

In the United Kingdom, the Director General of Water Services uses comparative information on water and sewerage companies in a variety of ways, but with particular emphasis on best practices.<sup>38</sup>

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<sup>37</sup> European Commission 98/511/EC, Recommendation Amending Recommendation 98/195/EC on Interconnection in a Liberalised Telecommunications Market (Part 1 – Interconnection Pricing), July 29, 1998.

<sup>38</sup> See the Monopolies and Mergers Commission’s discussion of the Director General’s comments, in its analysis of the proposed merger of Wessex Water Plc and South West Water Plc: Monopolies and Mergers Commission, *A report on the proposed merger*, October 1996, para. 2.70 (henceforth Monopolies and Mergers Commission).

### C. “Heightened Scrutiny for Poor Performance” Benchmarking

A third form of benchmarking is the identification of problem cases. The Commission makes extensive use of comparative data that it collects from ILECs to assess the performance of individual companies in setting rates, delivering service of satisfactory quality, and enforcing existing regulatory standards. In its investigations, the Commission frequently relies on several years of data for each ILEC and buttresses preliminary findings concerning individual companies with comparisons across companies. In this way, the Commission is able to identify extremes of sub-standard performance. The Commission can require the poorly-performing ILEC to “catch up,” impose regulatory sanctions or, at a minimum, instigate heightened regulatory scrutiny of the laggard ILEC. Not only does this potentially improve outcomes *ex post*, but the possibility that regulators may discipline sub-standard performance should improve ILECs’ incentives *ex ante*. Again, absent multiple ILECs, the Commission would often lack the information to do any of these things with much confidence. Below we list the factors at issue.

- *Collocation*. The Commission has evaluated the reasonableness of LECs’ charges for physical collocation services provided for interexchange access in terms of an industry-wide benchmark.<sup>39</sup> Collocation was a relatively new service for which little or no historical cost data and operating experience were available and for which LECs must make estimates of costs. For its statistical investigation, the Commission relied on direct cost estimates of 14 LECs<sup>40</sup> that offered collocation and had at least one

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<sup>39</sup> FCC 97-208, *In the Matter of Local Exchange Carriers’ Rates, Terms, and Conditions for Expanded Interconnection Through Physical Collocation for Special Access and Switched Transport*, Second Report and Order, CC Docket No. 93-162, released June 13, 1997.

<sup>40</sup> Pacific Bell, Nevada Bell, Southwestern Bell Telephone Company, Southwestern New England Telephone Company, Ameritech Operating Companies, New York Telephone and New England Telephone and Telegraph Company, BellSouth Telecommunications, Inc., US West Communications, Inc., GTE Telephone Operating

physical collocation customer. The Commission aggregated the LEC data for seven collocation functions: floor space, DC power, cross-connection and termination equipment, security installation, security escort, construction, and entrance facility. To minimize the impact of LEC estimation errors, it first excluded any cost estimate that exceeded the sample mean by more than two standard deviations (for that collocation function). The Commission then calculated the simple (unweighted) mean of the direct costs for each function and the sample standard deviation of the mean.

Deciding that it should recognize that some LECs may reasonably provide service somewhat less efficiently than other LECs, the Commission set the mean plus one estimated standard deviation as a maximum cost standard. Direct costs that exceed this value are disallowed, unless the LEC could justify the higher costs. The Commission used this methodology to ensure that the LECs' direct costs would fall within a "zone of reasonableness" and stated that the strict use of an average or median as the standard of reasonableness might not reflect the relative imprecision of the LECs' cost estimates for a new service.<sup>41</sup> In doing so, the Commission rejected a more lenient standard, observing that "all LECs have ample incentive to inflate the direct cost of physical collocation because these are the rates that they are imposing on the interconnector-customers against which the LECs compete in the interstate access market."<sup>42</sup> Thus, the Commission's procedure sets a benchmark for identifying poor

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Companies, Cincinnati Bell Telephone Companies, Lincoln Telephone and Telegraph Company, Rochester Telephone Corporation, and Central Telephone Companies.

<sup>41</sup> Id., para. 147.

<sup>42</sup> Id., para. 148.

performance that is based on both the average and the variance of industry-wide experience.

- *Overhead costs.* ILECs recover their common costs and costs of overhead activities by marking-up the direct costs of services. The Commission observed that assigning high overheads to the LEC facilities upon which interconnectors rely to provide competitive services, while assigning low overheads to services against which interconnectors seek to compete, is anticompetitive and that actions to raise rivals' costs through this mechanism can be profitable.<sup>43</sup> In its review of tariffs for virtual collocation, the Commission issued a detailed request for overheads and cost support data. Using the data submitted by the ILECs, the Common Carrier Bureau selected point-to-point DS1 and DS3 services as a yardstick to evaluate the overhead loadings assigned to virtual collocation services.<sup>44</sup> The Commission found that the LECs' loadings for DS1 and DS3 services varied widely, and observed that three RBOCs that used some of the highest overhead loadings also impose the highest total charges for virtual collocation services.<sup>45</sup> On the basis of this investigation, the Commission concluded that most of those LECs' virtual collocation rates were likely to be unreasonably high, and prescribed maximum permissible overhead loadings for virtual collocation services equal to the loadings for the comparable DS1 and DS3 services. By collecting comparative data on ILEC practices, the Commission was better able to detect and remedy potentially exclusionary conduct.

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<sup>43</sup> FCC DA-94-1421, Order, December 9, 1994, para. 23.

<sup>44</sup> *Id.*, para. 17.

<sup>45</sup> The LECs proposed to assign generally high loadings to collocation charges while assigning low loadings to comparable services.

- *Non-primary lines.* In its Access Charge Reform Order<sup>46</sup> the Commission modified the method for recovering common line costs and instituted a new flat, per-line charge (the Presubscribed Interexchange Carrier Charge – PICC) assessed on the customer’s presubscribed IXC. The new access charge regime requires LECs to distinguish between primary residential lines and non-primary residential lines. The rates for both the Subscriber Line Charge, which is paid by the end user, and the PICC are higher for non-primary residential lines. As a result, an ILEC with lower penetration of non-primary lines may be allowed to charge higher per-minute access fees.

The Commission investigated the penetration ratios for non-primary residential lines and found that several ILECs’ reported penetration ratios were increasing over time, but that the penetration ratios of SNET (now part of SBC) were much lower than expected. As “an initial test of reasonableness” the Commission calculated the average penetration of non-primary (second) residential lines for all price-capped LECs. The Commission tentatively concluded that SNET had under-represented the number of non-primary residential lines and ordered SNET to document in detail the procedures and data used to estimate non-primary residential lines and to present evidence to justify its low penetration ratio.<sup>47</sup> SNET has contended that it should not be required to undertake further measurements until the Commission formally establishes a definition of non-primary residential lines in a current proceeding.<sup>48</sup>

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<sup>46</sup> FCC 97-158, *In the Matter of Access Charge Reform*, First Report and Order, CC Docket No. 96-262, adopted May 7, 1997, released May 16, 1997.

<sup>47</sup> FCC 98-104, *In the Matter of 1998 Annual Access Tariff Filings, Southwestern Bell Telephone Company Revisions to Tariff FCC No. 73*. Memorandum Opinion and Order, Order Designating Issues for Investigation, and Order on Reconsideration, CC Docket 98-104, adopted July 29, 1998, released on July 29, 1998, paras. 15-19.

<sup>48</sup> CC Docket 98-104, Direct Case of the Southern New England Telephone Company, *In the Matter of 1998 Annual Access Tariff Filings*, August 31, 1998.

Surely, however, the availability of this kind of comparative information places the Commission in a much stronger position to defend consumers against the possibility that an ILEC understates the penetration of second lines.

Again, we note that U.S. telecommunications is not the only forum for such comparisons. For instance, the U.K.'s Director General of Water Services has promised stricter scrutiny for companies reporting relatively high costs.<sup>49</sup>

### **III. Effects of Mergers on Benchmarking**

In this section we use the analysis and discussion above to assess the effects of mergers among large ILECs on the efficacy of benchmarking. The Commission has recently clearly recognized that a merger of two RBOCs weakens its ability to use benchmarking to regulate effectively:

A reduction in the number of separately owned firms engaged in similar businesses will likely reduce this Commission's ability to identify, and therefore to contain, market power. One way that this can happen is by reducing the number of separately owned and operated carriers that can act as "benchmarks" for evaluating the conduct of other carriers or the industry as a whole.<sup>50</sup>

In this section we discuss the effects of ILEC mergers on the forms of benchmarking we have discussed above. We confirm that mergers can harm benchmarking – both through reducing available information even if ILECs do not change their substantive behavior, and also by worsening their incentives under benchmarking.

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<sup>49</sup> Office of Water Services (OFWAT), UK, *Setting Price Limits for Water and Sewerage Services: The Framework and Approach to the 1994 Periodic Review*. November 1993, p. 19.

<sup>50</sup> FCC 97-286, para. 147.

#### **A. A Merger Reduces Information from Benchmarking Even When Behavior is Unchanged**

Even ignoring incentive effects, if a merger leads to more aggregated reporting, valuable information is lost. In this sub-section we give a statistical formulation of this common-sense observation, intended to help analyze when it is likely to be important. After establishing the formulation, we discuss a rather stark best-practice example inspired by the number portability example above. Then we discuss effects on the use of average-practice benchmarking, both in terms of accuracy of the “average” as an estimate of an underlying parameter, and in terms of the effect of loss of observations on the confidence with which the Commission can wield this important tool. Finally, we note that these effects have been recognized elsewhere.

In many cases, after a phase-in period, the merged firm may adopt a common practice in such matters as pricing of services, availability of network components, and provisioning practices. Post-merger, only a single data point for these practices is then available for the two previously independent firms. In particular, useful financial information is likely to be reported at the firm level (aggregating across the merged operating companies). Even where the merged firm also reports company-by-company results, those values can be less useful than data from independent firms. Thus, the U.K.’s Monopolies and Mergers Commission (MMC), in considering the potential loss of independent observations through the merger of two water and sewerage companies, found that “the use of sub-company data is very much a second best ... first, that there are major cost allocation difficulties in the use of sub-company data and secondly, ... such data exhibit less variation and are hence less informative than they would be if they reflected the input of independent management.”<sup>51</sup>

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<sup>51</sup> Monopolies and Mergers Commission, para. 2.76.

Our setting is the following: Each of  $n$  ILECs (prior to a merger) reports a statistic  $x_i$ , where  $i = 1, \dots, n$ . Each  $x_i$  is drawn from a distribution with some parameter(s), say  $b$ , and thus contains information about  $b$ .<sup>52</sup> The Commission wishes to learn something about  $b$ , perhaps in order to set a performance standard. We note that because different errors in establishing a benchmark (setting too stringent a performance standard versus too lax a standard) often have asymmetric costs, the Commission should care not only about a posterior mean of  $b$  but also about measures of posterior dispersion (such as variance). In other words, as we remarked above in the concrete context of “ideal” price caps, (warranted) confidence in the benchmark is important.

We then ask: How does a merger that effectively aggregates some of the  $x_i$  before they are reported affect the Commission’s ability to infer  $b$  from the information it receives? While there are cases in which such a merger has no effect (at this level of analysis), the conditions for such neutrality are stringent and unlikely to hold in many regulatory contexts.

### *A Best-Practice Example*

Let us begin with an example in which one can see quite starkly how information can be lost in going to a single “merged” report based on what would otherwise have been independent observations  $x_1$  and  $x_2$ . Consider once again number portability as an illustration of best-practice benchmarking. Here, a model that captures our (and perhaps the Commission’s) thinking is that an unknown (to the Commission) parameter  $b$  is equal to 1 if LRN is reasonably implementable

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<sup>52</sup> The analysis is simplest if the  $x_i$  are independent and identically distributed, but that is not necessary for the basic insights.



in the near future, and is equal to 0 if it is not. For each firm  $i$  the observation  $x_i$  is, with probability  $p$ , equal to  $b$  (which may of course be 0 or 1), and, with probability  $1 - p$ , equal to 0.<sup>53</sup>

Then, a sufficient statistic for  $b$  is the maximum of the  $x_i$ . An admissible (and sensible) decision rule is to require LRN implementation if and only if that maximum value is 1: this is best-practice benchmarking. If instead of independent reports, only a merged report  $x_{1\&2}$  is available, the information on  $b$  is undamaged only in the special case where the merged report  $x_{1\&2}$  is constructed so as to equal  $\max[x_1, x_2]$ .

However, that is an unlikely form of aggregation. When, in fact, LRN is practicable, but only one of the merging partners wishes to offer it, it would be remarkable if the joint decision were always to offer LRN. A more reasonable hypothesis would be that when the partners have differing preferences it is equally likely that the merged firm would offer LRN or not. In our notation, if (say)  $x_1 = 0$  and  $x_2 = 1$ , then  $x_{1\&2}$  is equally likely to be 0 or 1. In that case, as with almost any aggregation rule, observing  $x_{1\&2}$  is strictly less informative than observing both  $x_1$  and  $x_2$ .

With this “equally-likely” aggregation rule, we can rather easily quantify the loss of useful information from such a merger. The key observation is that  $x_{1\&2}$  has the same distribution as a single draw  $x_i$ . To see this, note that with the “equally likely” aggregation rule, the probability that  $x_{1\&2} = 1$ , conditional on  $b = 1$ , is given by  $p^2 + 0.5[p(1-p) + (1-p)p] = p$ .<sup>54</sup> Conveniently, in this formulation, from the point of view of best-practice benchmarking, the

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<sup>53</sup> That is, with probability  $p$  firm  $i$  offers LRN, if indeed, it is practicable, and with probability  $1-p$  it does not, even if it would be practicable.

<sup>54</sup> Pre-merger, the probability that at least one of these two firms would reveal the feasibility of LRN is  $1 - (1 - p)^2$ .

merged firm is just like one of the original firms: mathematically, the merger then is equivalent (from this point of view) to a simple reduction in  $n$ .

For example, if pre-merger  $n=8$  and  $p=.125$  (perhaps a natural value to look at if we think in terms of the number portability experience, where one firm out of eight voluntarily implemented LRN), the probability that LRN is made available is given by  $1 - (1 - p)^n$ . Substituting for  $p$  and  $n$ , we see that this probability is 0.66. Now, suppose that two of the eight firms merge. Then, the probability falls to  $1 - (1 - p)^7 = 0.61$ . Similarly, if the eight original firms are reduced to four through four mergers, the probability falls from 0.66 to  $1 - (1 - p)^4 = 0.41$ . These are substantial effects.

#### *Effects of Merger in the Use of Averages*

Next, consider the reduction in information due to merger as it affects the use of average-practice benchmarking. We develop two points. First, the best point estimate of the underlying parameter  $b$  – loosely, an “average” – may in fact depend on more than a simple weighted average of firms’ reports, so that “the average” may be less accurately calculated after a merger. Second, losing information on variation among ILECs may rationally cause a loss of the confidence needed to use an average as a benchmark, and may make regulators or competitors more tentative in their use of such averages.

For a concrete example, we examine price-cap performance. We can view  $x_i$  as firm  $i$ ’s productivity performance, and model this performance as the sum of two terms – a “normally achievable” performance  $b$ , plus an idiosyncratic “error”  $e_i$  with mean zero. Thus, from the information point of view, the Commission is comfortable in applying the average-performance benchmark to firm  $i$  to the extent it believes that benchmark is a reasonably good estimate of what firm  $i$  is capable of achieving.

With standard assumptions, a consistent estimate of  $b$  is obtained simply by averaging the observations  $x_i$ . If the error terms are uncorrelated across firms and their variances are known and proportional to the squared sizes of the ILECs (where size is measured, say, by number of lines), then an efficient estimate of  $b$  is the size-weighted “sample mean” or average of the  $x_i$ .

In this special case, the “neutrality” result mentioned above holds: the estimate of  $b$ , and its statistical precision, are unaffected by a merger between firms 1 and 2 even if achieved productivity following a merger is reported only at the consolidated level. Intuitively, since the optimal use of all the  $x_i$  was merely to take the weighted average anyway, nothing has been lost if two observations were merged into a “within-group” weighted average before being reported.

But even modest changes in these assumptions bring us back to the fact that, in general, it is strictly more informative to observe all the diversity. For instance, consider the case where, as is the case for price caps, the covariance structure of the  $e_i$  cannot be taken as known and diagonal. Some unobserved effects in the error term may be common to several firms in a given year and other unobserved effects may persist for several years for a single firm. Because the covariance structure cannot be taken as known *a priori*, an efficient estimate of the performance *will not* use solely the weighted mean of the observations  $x_i$ .<sup>55</sup> The Commission’s inferences about  $b$  will then be predictably less accurate if it has reliable access only to the weighted mean of  $x_1$  and  $x_2$  rather than to both of these variables. In other words, a merger hurts the process.

More generally, the Commission often lacks strong *a priori* knowledge of the variance with which the observations  $x_i$  are distributed around the unknown  $b$ . This is particularly likely in a *sui generis* proceeding as compared with one designed to measure recent changes in

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<sup>55</sup> For example, generalized least squares estimation uses the observations  $x_i$  to estimate a covariance structure and thus to construct a more efficient estimate of the unknown parameter  $b$ .

productivity. Specifically, consider the standard Bayesian model in which the  $x_i$  are independent draws from a normal distribution with unknown mean  $b$  and unknown standard deviation  $\sigma$ , and in which the prior distribution of  $b$  and of  $\log(\sigma)$  is the improper uniform.<sup>56</sup> The observer's point (posterior mean) estimate of  $b$  is the average of the  $x_i$ . As above, this is unaffected by the reporting only of average information. But nevertheless the posterior distribution of  $b$  depends on the separate observations  $x_i$ . Observing only pre-averaged data increases the posterior variance of  $b$ , because the observer has less information and thus must be less confident.

For example, suppose we begin with  $n=8$ . Then the posterior variance is given by<sup>57</sup>  $[(n-1)/(n(n-3))]s^2$ , an expression that depends on the sample variance  $s^2$ , but whose prior expectation is equal to  $(7/40)\sigma^2$ . Now if a series of mergers<sup>58</sup> reduces  $n$  to 4, we will have half as many observations, each of which is now normally distributed around the unknown  $b$  with (unknown) variance  $\sigma^2/2$ . The prior expectation of the posterior variance of  $b$  is now equal to  $(3/4)\sigma^2/2 = (15/40)\sigma^2$ . The result of this (semi-hypothetical) wave of ILEC mergers is that (in prior expectation) the posterior variance on  $b$  more than doubles. As a result, the Commission must be less confident in its estimate of industry performance and more circumspect in establishing any performance standard.

As this conclusion suggests, the Commission often wishes to make a rule but to be reasonably confident that it is not unduly harsh. In many problems, including price caps and

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<sup>56</sup> See, for instance, George G. Judge, R. Carter Hill, William E. Griffiths, Helmut Lütkepohl, and Tsoung-Chao Lee, *Introduction to the Theory and Practice of Econometrics*, 2<sup>nd</sup> Edition, 1988, p. 150.

<sup>57</sup> See Judge et al., p. 152.

<sup>58</sup> We make this version of the comparison to avoid the analytical complexity of having just one pre-averaged (paired) observation. However, we note that if the SBC/Ameritech and Bell Atlantic/GTE mergers were to take place, since the passage of the Telecommunications Act, the eight largest ILECs would in fact have been reduced to four.

universal service support, this can be formulated as a desire to set a performance standard  $y$  as demanding (say, as low) as possible but such that the probability that  $y$  is less than the unknown  $b$  is acceptably low. Statistically, this amounts to finding a confidence interval.

In most instances, the degree of variability will not be known in advance, and the Commission must generally rely on experience reported by the ILECs to arrive at a suitable confidence interval (in estimation terms) or band of tolerance (in behavioral terms). In this way, the data will be used for more than a point estimate of  $b$ .

An example that comes close to explicitly formulating the problem as the choice of a confidence interval is the FCC's proceeding on physical collocation. In this proceeding, which began in 1993, the Commission analyzed the cost estimates of 14 ILECs. The Commission had available different numbers of observations for the different collocation functions, depending on the types of facilities used by the companies.<sup>59</sup> The number of observations ranged from 12, for DS1 cross-connection and termination equipment, to just 3 for one type of security installation.

Four of the companies (Pacific Bell, Nevada Bell, Southwestern Bell, and SNET) are today part of SBC, and two others (Bell Atlantic and NYNEX) are merged into Bell Atlantic. If Ameritech and SBC merge, what was 14 will become 9; if, in addition, Bell Atlantic and GTE merge, the number drops to 8. If the Commission's calculations were repeated beginning from just 9 ILECs, the number of observations would decline to 8 for DS1 cross-connection and termination, and remain at 3 for the security installation. A merger of Bell Atlantic and GTE would further reduce the range for some collocation functions.

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<sup>59</sup> And after removing very high cost estimates (those that exceeded the sample mean plus two sample standard deviations).

The reduced number of direct cost estimates increases the variability of the Commission's cost standard for a zone of reasonableness – the sample mean plus one sample standard deviation.<sup>60</sup> In a framework of Bayesian estimation of a parameter  $b$  and its distribution, the Commission must have reduced confidence that its mean-plus-one-standard-deviation interval actually covers the range of costs of efficient ILECs. To achieve the same degree of confidence with fewer observations, the Commission would have to increase the size of the interval. However, the Commission rejected such a lax interval.

As the number of ILEC observations is reduced by mergers, the Commission's power to constrain excessive pricing by this kind of benchmarking is weakened and the tools for setting bands of reasonable costs ultimately become ineffective. To make this point most starkly, consider an industry with just two firms, and suppose that the Commission were to stick to the "mean plus one standard deviation" standard. Let the two observations be  $x_1$  and  $x_2 \geq x_1$ , so that the sample mean is  $(x_1 + x_2)/2$ , and the sample standard deviation is  $\sqrt{2} (x_2 - x_1)/2$ . The Commission's zone of reasonableness, which allows everything up to one sample standard deviation above the sample mean, is now so large that even the maximum observation,  $x_2$ , is *certain* to be judged reasonable! In other words, the technique now has no bite whatsoever. The standard would have to be even more lax, if that were imaginable, if the Commission took account of the lower probability that a one-standard-deviation allowance would truly cover sampling variation because of the low numbers.<sup>61</sup>

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<sup>60</sup> We simulated the sample mean plus 1 sample standard deviation in repeated trials with 12 observations and then with 9 observations drawn from a normal population with mean and variance equal to the sample mean and sample variance for DS1 cross-connection and termination. We found that the reduced number of observations increased the standard deviation of the mean plus 1 standard deviation by 15.9%.

<sup>61</sup> With  $n=2$  and independent normal errors, the classical probability that the sample mean plus 1 sample standard deviation exceeds the population mean is only 0.75. (75% of the standard  $t$  distribution with one degree of freedom

### *Regulators Recognize the Problem*

In summary, we have seen how mergers reduce the flow of information for benchmarking purposes, even if we assume away all incentive effects of the merger. Indeed, this effect has been recognized both by the Commission and by others. For instance, the Commission has noted, “[m]ergers between incumbent LECs will likely reduce experimentation and diversity of viewpoints in the process of opening markets to competition.”<sup>62</sup> Similarly, in the U. K., benchmark comparisons are used to compare the efficiency of monopoly water and sewerage companies operating in different geographic districts and to set company-specific price caps. The essential value of having comparative data from independent firms is recognized in the statutory requirements. Under the 1989 Water Act, the Monopolies and Mergers Commission (MMC) is required to take account of the loss of comparative information that would result from a merger of water companies.<sup>63</sup> The MMC recently examined a proposed merger between two water and sewerage companies and applied this standard.

Two studies submitted to the MMC provided estimates of likely losses due to (1) loss of the observation of a best-practice firm at some stage in the future, and (2) setting of less stringent price benchmarks because of greater uncertainty. The MMC noted that many other dimensions in which comparators are used in the comparative process had not been valued, and it recognized that individual companies also make particular contributions in specific comparative exercises. In summary, the MMC found that, although it was unable to quantify exactly the loss from removal of one firm (South West Water) from the comparative process, “we are satisfied that it

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lies below 1.) To define a zone of reasonableness that would have 90% probability of including the population mean one would have to allow variability of 3 standard deviations.

<sup>62</sup> FCC 97-286, para. 152.

<sup>63</sup> Water Industry Act, 1991, Part II, 34 (3).

would be a substantial one.”<sup>64</sup> The MMC blocked the proposed merger that would have reduced the number of independent sewerage services companies from ten to nine. It found that “no remedy, even in the shape of very significant price reductions, would be sufficient to compensate for the loss of [South West Water Services] as a comparator.”<sup>65</sup>

## **B. Unilateral Incentive Effects**

A merger between firms with market power that compete in a product market has anticompetitive incentive effects that are well understood by competition authorities.<sup>66</sup> The “unilateral” effects stem from each merging party’s new incentive to help, or not hurt, its new partner.

When two firms compete in a product market, each has opportunities to engage in behaviors that (i) are socially desirable, (ii) are profitable for that firm, (iii) reduce the profits of the other firm, and (iv) therefore are less likely to take place after a merger between the firms. In the case of product-market competition, “lowering price towards marginal cost” is the paradigmatic example of such behavior, although quality improvements, innovation, and other effects are also (and in some cases more) important. For this reason, antitrust authorities will challenge a merger between such firms if consumers lack adequate other alternatives, and if the change in incentives is likely to lead to significant worsenings of the firms’ offers to consumers.

When two regulated, geographically-separated ILECs face competition-by-comparison through benchmark regulation, similar economic forces are at work. The socially desirable actions

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<sup>64</sup> Monopolies and Mergers Commission, para. 2.83, 2.85.

<sup>65</sup> Monopolies and Mergers Commission, para. 1.14; quoted in S.G.B. Cowan, “Competition in the Water Industry,” *Oxford Review of Economic Policy*, Vol. 13, No. 1, Spring 1997, p. 85.

<sup>66</sup> U. S. Department of Justice and the Federal Trade Commission, *Horizontal Merger Guidelines*, April 2, 1992 (revised April 8, 1997).



to consider now include: (a) lowering recorded access costs, (b) introducing new services that raise the average revenue per line, (c) cooperating more fully with regulation and with the introduction of local competition, and (d) once ILECs are offering in-region long-distance service, cooperating in difficult-to-enforce ways with rival IXCs. In each case, each ILEC may sometimes be willing to take such actions, but in general such actions would hurt other ILECs. After a merger, the merger partners internalize those cross-effects and become less likely to take such actions. In addition, as Katz and Salop argue, a merged firm may have stronger incentives to deny competitive accommodations and engage in exclusionary conduct toward rivals than has either merger partner separately.<sup>67</sup> When reflected in discriminatory conduct, these incentives worsen the comparative information available and impair average-practice, best-practice, and other forms of benchmarking.

### **1. Unilateral Incentive Effects of Merger under Average-Practice Benchmarking**

Average-practice benchmarking sets firms into a form of competition with one another even if they do not compete in any conventional product market. As John Vickers has expressed it, if two agents face a similar incentive scheme in which each agent's rewards are based both on its own and another's performance, the agents "are in competition in the sense that the reward of each partly depends on performance relative to that of the other agent."<sup>68</sup> The establishment of benchmarks thus creates "competition-by-comparison" between firms that do not directly compete with each other in the same geographic markets.

As one might expect from this observation, mergers between firms whose performance is regularly compared under benchmarking can have adverse unilateral incentive effects that are

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<sup>67</sup> Katz and Salop, Section VI.

<sup>68</sup> John Vickers, "Concepts of Competition," *Oxford Economic Papers*, January 1995, Vol. 47, No. 1, p. 10.

very similar to the corresponding anticompetitive effects of mergers among direct product-market competitors. Thus, consider the effect of a merger on the benchmark used for price-cap regulation. After the merger, each of the original firms will internalize the effect of its productivity improvements on its partner's profits. Compared to before the merger when the firms were competitors-by-comparison, this effect is a negative one.<sup>69</sup>

If (say) SBC lowers its recorded access costs, it is likely that the X-factor(s) set at a subsequent price cap performance review will be greater as a result. The increased X-factor will make Ameritech (as well as other price-cap ILECs) less well off. Post-merger, the incentive for the merged firm to reduce its costs in the former SBC's area will therefore be lower than the incentives SBC faced pre-merger. Symmetrically, Ameritech's incentive to increase efficiency also declines.

To continue the example used earlier, after a merger of two ILECs, each of which has 20% of the total access lines, a larger ILEC, with 40% of the access lines, keeps only 60% (i.e., 100% - 40%) of the cost reduction after the readjustment has taken effect. Thus, this larger ILEC's gross private present-value return per line becomes

$$$(1 + .91 + .83 + .75) + .6*(.68 + .62 + .56 + \dots) = \$ 7.99$$

so that this larger ILEC faces a "tax" of 27% (i.e.,  $7.99/11 = .73 = 1 - .27$ ). The point is that a cost-reducing action by one of the original firms will reduce the access price that can be charged by its partner. The prospect that access charges will be adjusted in the light of the firm's own productivity experience creates a "tax" on the increased profits that each of the merged ILECs

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<sup>69</sup> Although ILECs in different geographic areas are also suppliers of complements – each supplies originating access for calls terminating in the other's territory – this effect is surely small compared to the effects considered here.

realizes from investments that increase its productivity. As a result of the merger, the amount of “tax” increases because the effect on the merging partner is internalized.

We note that a simple comparison of these illustrative numbers – a 27% “tax” versus a 14% tax – may not fully convey to non-economists the difference in impacts. Economic logic tells us that the harm caused by a tax, or by a distortion of incentives away from the efficient level, is broadly proportional to the *square* of the distortion. Thus, a “tax” that is twice as large causes not twice as much, but approximately *four* times as much, economic loss.<sup>70</sup>

Clearly these numbers are illustrative, rather than precise, calculations. However, we believe that they correctly suggest that an increase in the share of nationwide lines controlled by a single company, such as would occur under the proposed SBC/Ameritech merger, substantially worsens the ratchet effect created by periodic revision of the X-factor. Under a system of benchmarking that uses industry-wide averages of cost performance, the larger the ILEC, the worse the ratchet effect.

Studies of the effect of corporate tax rates and tax credits on research and development spending suggest that R&D expenditures are relatively price-elastic with respect to tax rates.<sup>71</sup> This

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<sup>70</sup> This observation is a staple of economic analysis. Roughly, it can be explained as follows, for the simple case in which projects’ gross returns are approximately uniformly distributed (at least in expectation). In expectation, a tax that is twice as large will discourage about twice as many efficient projects, because it puts twice as large a range “below the threshold.” In addition, the average discouraged project is approximately twice as valuable in pre-tax (i.e., efficiency) terms.

<sup>71</sup> See, e.g., Bronwyn Hall, “R&D Tax Policy During the 1980s: Success or Failure?”, *Tax Policy and the Economy* 7: 2-35, 1993; Philip Berger, “Tax Incentives for R&D: What Do the Data Tell Us?”, *Council on Research and Technology*, Washington, photocopied, 1992; James Hines, “On the Sensitivity of R&D to Delicate Tax Changes: The Behavior of U.S. Multinationals in the 1980s,” in Alberto Giovannini, Glenn Hubbard, and Joel Slemrod (eds.), *Studies in International Taxation* (University of Chicago Press: Chicago), 1993; Theofanis Mamuneas, and M. Ishaq Nadiri “Public R&D Policies and Cost Behavior of the U.S. Manufacturing Industries,” *Journal of Public Economics* 63: 57-81, 1996.

effect makes it more likely that, as a result of a merger, the firms will allocate fewer resources to activities that would reduce costs but would also affect a benchmark.<sup>72</sup>

Finally, while a merger between SBC and Ameritech does not affect the immediate *incentives* of “third” ILECs (such as Bell South) under an average-performance scheme, there is nevertheless a plausible effect on their *actions*. In particular, Bell South may be less likely to trim its own excess costs if SBC and Ameritech face weakened incentives to trim theirs.<sup>73</sup> The net result can be expected to be a slower rate of productivity improvement throughout the industry, and consequent harm to consumers, as competition-by-comparison is weakened through merger.

The merger of SBC and Ameritech would also impair the effectiveness of average-practice benchmarking in the universal service support program, and for very similar reasons. To illustrate, suppose that SBC introduces new services that are valued by consumers, and thereby raises its average revenue per line. In due course, this will be reflected in a higher revenue-per-line benchmark for calculating high-cost support. As a result, carriers collecting high-cost support funds based on the difference between their estimated costs of serving high-cost areas and the benchmark revenue per line will receive less support. If SBC’s merger partner, Ameritech, is such a carrier, post-merger SBC will internalize this effect and it will have less incentive to introduce such new services. In the same fashion, Ameritech will have a reduced incentive to introduce new revenue-increasing services because it will take into account the potential for reduced support that could flow to SBC in its high-cost service areas.

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<sup>72</sup> This effect must be set against any merger-specific economies of scale in innovation. We note, however, that because licensing of innovations among ILECs faces no obvious barriers, one might be suspicious of claims that such economies of scale are merger-specific.

<sup>73</sup> Although there is no first-order effect on Bell South’s incentives to cut its costs, if it becomes richer and “fatter” (as it will if merging ILECs cut back on their cost-reduction), it may nevertheless (perhaps because of managerial principal-agent problems) experience cost inflation itself. See Michael Jensen, “Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers,” *American Economic Review*, 76:2 (May, 1986), pp. 323-329.

## 2. Unilateral Incentive Effects of Merger under Best-Practice Benchmarking

A merger will similarly weaken the effectiveness of best-practice benchmarking because of the adverse (unilateral) *incentive* effects of taking a merger partner's interests into account. In our analysis of this problem, we distinguish two cases: (a) the merged firm sets a common practice for both partners, and (b) formerly independent (now merged) firms maintain two different practices. Although the analysis is somewhat different, the key themes and qualitative result – a loss of effectiveness for best-practice benchmarking – are the same in both cases.

When the merged firm sets a common practice, if firms' practices can be represented numerically (as with collocation charges or overhead rates), the common practice value of the merged firm is likely to lie strictly between the practices that the parties would have set separately absent the merger. As noted above, under best-practice benchmarking, only the best observation among all firms ultimately counts. Thus, either the merger makes no difference (because neither merging party would have provided that best observation), or the merger moves the firm with the best practice toward the other partner's preferences (because the best-practice firm now internalizes the effect on its partner). In the latter case the merger produces an undesirable change.

For example, suppose that Ameritech as a stand-alone RBOC would offer collocation charges of \$X, an offer that turns out to be "best practice" among the ILECs, while SBC as a stand-alone entity would offer higher charges of \$Y. In the absence of a merger, Ameritech's offer would be imposed as the benchmark, and SBC would be limited to charges of \$X. Post-merger, decisionmakers for the merged company select a common charge for both partners that maximizes their total net benefit. As we noted above, one would expect this single policy to be set somewhere between the two pre-merger policies, \$X and \$Y, which implies that it would be higher than \$X.

Consequently, post-merger the observed best practice is inferior to the best practice absent the merger.

In some cases, the merged firm will maintain different practices. In this case, too, there is an incentive to “shade” the previously independent choice in the direction of the less cooperative merger partner’s preference. To illustrate this incentive, suppose that the Commission were to use a best-practice standard to establish maximum rates for collocation services and that each ILEC recognizes in advance that best-practice benchmarking is likely to be applied to collocation charges. Acting independently, each ILEC would offer collocation charges reflecting its own cost conditions and strategic goals, as well as other factors such as the intensity of state regulatory scrutiny.

However, if the firms merge, Ameritech's decision-makers would take into account that SBC’s preferred charges are \$Y and that the practice that Ameritech sets, \$X, may be selected by the regulator as best-practice and applied to SBC as well. The decision-makers who maximize the joint profits of the merged companies, or even take SBC’s preferences into account more weakly, would shade the offer of \$X towards \$Y – that is, the offered collocation rate would be higher. As a result, the benchmark charges would end up higher: either the shaded offer remains best practice, or another ILEC's offer, (by assumption higher than \$X), is now best practice.

It is important to note that even if (in this example) Ameritech’s influence brings SBC’s preferred charge down from \$Y towards \$X, under best-practice benchmarking this reduction does not matter.<sup>74</sup> While a merger between an ILEC that (in a particular matter) is cooperative with new competitors and one that is intransigent may moderate the behavior of both, under best-

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<sup>74</sup> Assuming, that is, that Y is not so “moderated” as to fall below X.

practice benchmarking it is only the merger's effect on the cooperative ILEC that affects the final result.

In summary, then, there is an adverse incentive effect of a merger when the merging firms' practices are compared by regulators and best practices are promoted. This is distinct from, although analogous to, the adverse incentive effect of the merger under average-practice benchmarking.

### **C. Coordinated Effects and Risk of Collusion**

Recall from our discussion above that, under competition-by-comparison (as under product-market competition), each ILEC can undertake actions that are socially desirable and profitable but that harm the interests of other ILECs. A merger can increase the threat that a common understanding will develop (explicitly or implicitly) not to engage in such behavior. We believe that a substantial decrease in the number of relevant independent firms (and for some purposes only large ILECs may be relevant firms) can significantly increase this threat.

This, too, is not a novel point. Indeed, the Commission has observed that, although ILECs have a common interest in minimizing their cooperation with regulators and competitors who are seeking to open their local markets to competition, "On any particular issue, however, one incumbent LEC may have an incentive to cooperate with its competitors, contrary to the interests of other LECs," an incentive that may arise from regional differences between the ILECs.<sup>75</sup> The Commission rightly observed that if two major ILECs merge, the incentive for an individual ILEC to "break ranks" and cooperate with pro-competitive processes may be reduced. The number-portability example that we described earlier strikingly illustrates such a possibility.

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<sup>75</sup> FCC 97-286, para. 154.

As in the product-market case, such parallelism is more likely the smaller the number of large ILECs. In large part, this is because of the diversity discussed above in the context of best-practice benchmarking. That is, with many ILECs, it is more likely that there will be one or two mavericks on any complex issue. With a large number of players, an ILEC contemplating aggressively cutting costs or boldly innovating will be less inclined to worry about offending the others by breaking an otherwise united front. By contrast, as the number of ILECs is reduced by merger, they become more likely to be able to coordinate their behavior and refrain from socially desirable actions. In this sub-section, we expand on this point.

As above, suppose first that each of  $n$  independent ILECs will, with probability  $p$ , take the socially desirable action. We next investigate the tradeoff between unilateral incentives to do so and coordinated incentives to maintain a united front. Suppose that an ILEC may, for its own reasons, prefer to take the socially desirable action in a matter at hand, but would also derive future value if a united position is maintained that would provide benefits in future regulatory matters. By hypothesis, if this ILEC goes along with the putative united front, it incurs some private cost  $c$ . This private cost, and even the fact that it is positive, are likely to be difficult for others to observe.

An ILEC in this position trades off  $c$  against the possibility that its action determines whether the united front – which it values at  $B$  – is maintained. (It may value this because of the prospect of preferring the united front on future matters, for instance.) Then this ILEC will reflect that, apart from its own action, with probability  $q_n = (1 - p)^{n-1}$  the front is united, so that its own action determines whether the united front is maintained. As a result, it will cooperate with the united front if, and only if,  $q_n B > c$ .



Observe now that the probability  $q_n$  is decreasing in  $n$  for a given value of  $p$ , so that  $q_n$  increases with a merger. Also recall that (under a reasonable symmetric model of how conflicts between merger partners are resolved) a merger can be modeled simply as a reduction in  $n$ . So, a merger will make it more likely that a united front is maintained, conditional on each ILEC's choice of  $p$ . This effect, which we discussed above in subsection III.A, has nothing to do with incentives (it holds  $p$  constant), but is purely a statistical (information) effect.

There is *also* an incentive effect, however. This is best seen in a Bayesian equilibrium of an incomplete-information game among the ILECs. Suppose for instance (plausibly enough) that each ILEC's value of maintaining a united front,  $B$ , and/or its value of  $c$  for a particular matter, are private information. Then this ILEC will maintain the united front if and only if, for its particular values,  $c/B$  is less than the perceived probability  $q_n$  that all others will maintain the united front. As a result, the probability that it chooses, instead, to be a maverick is  $p(q_n)$ , a decreasing best-response function.

Taking as given other ILECs' choices of  $p$ , any one individual ILEC's incentive to maintain the united front is increased by a merger. Because there is no point in playing on the team if others fail to do so, an increase in the perceived probability  $q_n$  that all others will do so – such as follows from a reduction in  $n$  holding  $p$  constant – therefore also makes each individual ILEC more inclined to go along with the (perhaps) united front and less inclined to be a maverick. Thus, the merger causes each ILEC's optimized  $p$  to fall, even if it takes others' values of  $p$  to be fixed (unaffected by the merger). Furthermore, if the ILEC recognizes this effect, it will know that others' values of  $p$  have, in fact, fallen, so that  $q$  is now even higher, further reinforcing its own incentive to reduce its  $p$ .

This analysis illustrates how a reduction in  $n$  can make maintenance of a united front more likely, both statistically, given each ILEC's  $p$  (as analyzed above), and also behaviorally, through the effect on  $p$ . Thus, a decrease in the number of firms through merger can increase the likelihood that the ILECs will achieve a united front inimical to cooperation with regulators and competitors.

#### **D. Effects of Merger on “Purified” Benchmarks.**

Yardstick competition can in principle eliminate the ratchet effect in average-performance benchmarking by setting a separate firm-specific benchmark for each firm. The Commission appears generally to have avoided this practice, possibly because of the difficulty of arguing persuasively that a common standard is being applied to all firms. Another problem is that, to the extent there are durable firm-specific effects or modest numbers of firms, as an estimate of what an individual firm is capable of achieving, a purified benchmark is statistically inefficient – although efficient in incentive terms.

Whatever the merits and defects of purified benchmarks, our goal here is to understand the effects of a merger among large ILECs. The primary effect of such a merger on purified benchmarking is that each merging ILEC's “target” or performance standard must become “noisier,” because purified benchmarks impose the constraint that (for instance) Ameritech's performance receive zero weight in setting a target for SBC, and vice versa. Since it would be very unlikely absent the merger that no weight would be given to Ameritech's performance in setting an efficient purified benchmark for SBC, this is a loss.

This analysis applies when the regulator sets a very simple “average” purified benchmark. A related effect, however, applies to non-merging parties as well. That is, the ability to adjust a benchmark for firm-specific effects is impaired. “Where econometric analysis is needed before

comparisons can be drawn between companies with diverse operating environments, it is important that the number of separate observations relative to the number of explanatory variables that should be included in any model is sufficient.”<sup>76</sup>

#### **IV. Conclusion**

Our discussion of the use of comparative and benchmark techniques by telecommunications regulators illustrates one of the important losses from mergers among large ILECs. We note again that not only regulators but also customers and suppliers of complements (such as IXC), as well as nascent competitors, can and do compare ILECs against one another. The loss of one of a relative handful of large ILECs would substantially damage efficient regulation, including the interconnection regulation necessary for the growth of competition in local exchange and exchange access markets.

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<sup>76</sup> Monopolies and Mergers Commission, para. 2.43.